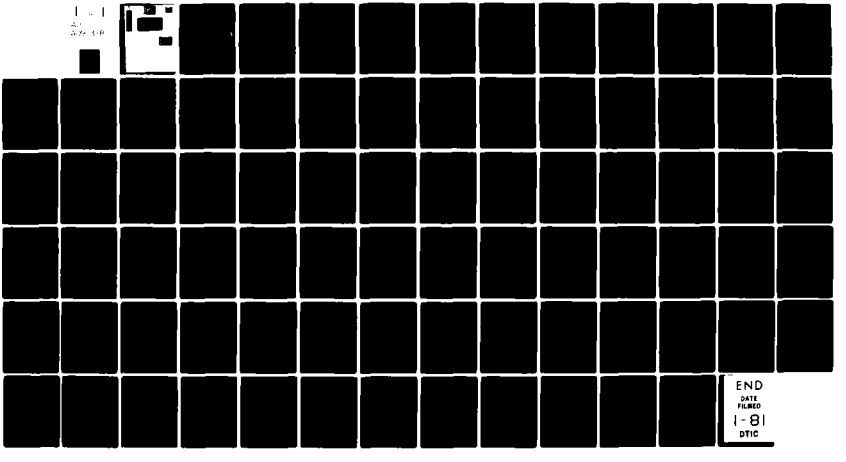
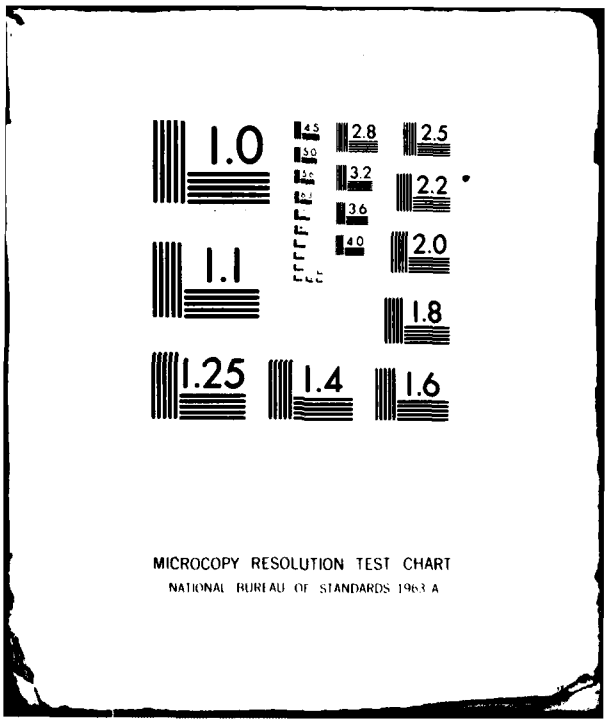
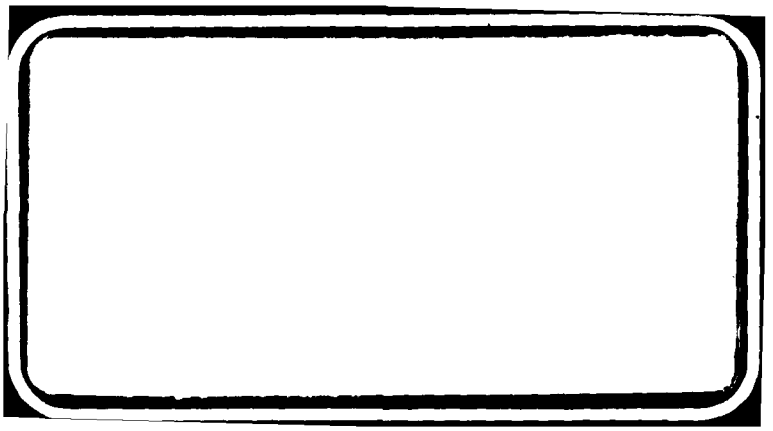
AD-A092 368 DEFENCE AND CIVIL INST OF ENVIRONMENTAL MEDICINE DOW--ETC F/G 6/19
AIR SATURATION DIVE 4 - 8 FEBRUARY 1980, CEDD TEST NUMBER 1-80.(U)
SEP 80

UNCLASSIFIED DCIEM-80-C-31 NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A



(11) September, 1980

(9) DCIEM Technical Communication No. 80-C-31

(14) DCIEM-80-C-31

(3)

AIR SATURATION DIVE
4 - 8 FEBRUARY 1980
CEDD TEST NUMBER 1-80

(12) 89 p.

Lieutenant-Commander B.A. Ridgewell
Director, Diving Division

Lieutenant M.D. Kooner RN
Sat Dive Project Officer

AD-A096986

TABLE OF CONTENTS

PART I

GENERAL AND ADMINISTRATION

PROTOCOL

PART 1 - GENERAL AND ADMINISTRATION

1.1 INTRODUCTION

The Diving Division in conjunction with the Biosciences Division will carry out an air saturation dive in the Diving Research Facility, DCIEM commencing 4 Feb 80 and concluding 8 Feb 80. This dive will necessitate a pre-dive work-up period from 14 Jan - 4 Feb 80 and a post-dive clean-up period from 8-15 Feb 80.

1.2 AIM

The aim of this exercise is to conduct a 15.3 msw saturation dive with an excursion to 34 msw. The objectives of this dive are as follows:

a. to acquire operational experience in saturation diving;

b. to test and evaluate two diver life-support systems and three physiological monitoring systems under hyperbaric conditions; and

c. to collect physiological data to measure man's capability to perform underwater work.

1.3 BACKGROUND

Historical Review. Experimental diving has been conducted at the Defence and Civil Institute of Environmental Medicine since the early 1960's. However, by the early 1970's, undersea technology had advanced to such a degree that the Institute's hyperbaric facilities were totally inadequate to continue physiological experimentation deeper than 300 ft (90m) or unmanned diving equipment evaluations deeper than 1000 ft (300m).

During the period 1971-1973 the Federal Government enunciated in two major policy statements the requirement for "Canada to increase its underwater capability in the field of underwater exploration and development". In 1972, in response to the government's stated policies on underwater development, and in conjunction with the SDL-1 Minor Development Programme, the Institute began the conceptual planning for a high pressure diving simulation facility. The existing hyperbaric facilities would address the shallow depth problems, whereas the new facility, with a dept capability of 5600 ft could investigate the physiological and equipment problems associated with cold, deep water diving in the Continental Shelf waters of Canada's Atlantic, Arctic and Pacific Oceans.

The conceptual design and cost estimates of the Diving Research Facility (DRF) were submitted to National Defence Headquarters and final approval to proceed was obtained in 1973. On 29 July, 1977 the chamber complex was installed at DCIEM.

Outfitting and interfacing of existing sub-systems commenced immediately. During this period it was determined that, prior to any manned pressurized dive utilizing the DRF, it was mandatory to conduct a habitability study of the total system. Based on this requirement, "Operation CETPE" was carried out in January, 1979.

1.4 OPERATION CETPE

The objectives of "Operation CETPE" (Chamber Equipment Testing and Procedures Evaluation) were to conduct a seven-day, one atmosphere saturation dive, utilizing the DRF, in order to establish base-line data in the related scientific diving disciplines, to evaluate the operational and functional aspects of the specific support systems, and to provide hands-on training of diving personnel in the specific systems involved.

Operation CETPE was a success and prompted many recommendations. The main conclusion drawn was that the experience gained would contribute to the safe and efficient handling of future saturation dives and physiological experimentation in the DRF complex.

1.5 XDC-2 COMPUTER VALIDATION DIVES

Since CETPE, the Diving Research Facility has been used successfully in two separate operations known as Phase I and Phase II XDC-2 Validation Dives. These exercises basically ascertained the operational envelopes of the XDC-2 Diving Decompression Computer within the 30-75 msw range using air as the breathing gas and were carried out from 19 Jun to 13 Jul and 5-16 Nov 79 respectively.

1.6 PROCEDURES FOR AIR SAT DIVE

All procedures will be carried out in accordance with normal safe diving practices and scientific experimentation will be carried out in accordance with the guidelines of the DCIEM Human Ethics Committee.

The Standard Operating Procedures, Schedule of Events, Dive Profile and Scientific Protocol are to be followed throughout the exercise and, wherever humanly possible, strictly adhered to. The Protocol is to be regarded as a legal document between subject operators and experimenters and, therefore, changes in the Protocol may only be authorized by the Director, Diving Division after consultation with the subjects and relevant scientist.

Emergency procedures and relevant equipment/system check-off sheets for the safe operation of the DRF will be made available at the respective control consoles.

All diving SOP's will be carried out in accordance with Part II of the Protocol and the relevant Annexes.

All hyperbaric operations will be carried out in accordance with Part III of the Protocol.

All engineering practices will be carried out in accordance with Part IV of the Protocol.

All medical practices will be carried out in accordance with Part V of the Protocol.

All scientific practices will be carried out in accordance with Part VI of the Protocol and relevant Annexes.

1.7 SUPPORT AND LOGISTICS

Medical support will be provided throughout this operation by the Diving Division Medical Officers and CFB Toronto MIR if required.

Scientific support will be provided by the Diving Division in conjunction with the Biosciences Division, DCIEM.

Operational and Engineering support will be provided by the Diving Division and Technical Services Division.

Logistic support will be provided by CFB Toronto in the form of Base transportation; rations and quarters will be available for operators.

Logistic support in the form of rations will be provided by DCIEM cafeteria for those on duty at the dive site as requested in the relevant memoranda.

1.8 DIVING WATCHES

Three eight-hour watches shall be implemented for this operation. Watches will be from 0800-1600, 1600-0000, and 0000-0800 respectively.

A watch crew will consist of a Watch Officer, Chief Controller, Controller and Assistant Controller. A Medical Officer and a DRF Engineer will also be within designated areas throughout the 24-hour period.

The Watch Bill and Watch Schedules are shown in Annex A to this part. No alterations to the Watch Bill will be accepted without prior permission of the Director, Diving Division.

1.9 DCS WATCH

The Decompression Sickness Watch (DCS) for the detection of decompression sickness will be activated immediately after surfacing and will be carried out in two parts. The first part will be within the confines of DCIEM and will terminate six hours after surfacing. The second part will be for a period of 12 hours during which time personnel will be on immediate recall to DCIEM.

ANNEX A
TO PART I
CEDD TEST NO. 1-80

WATCH BILL

POSITION	WATCH A	WATCH B	WATCH C
Watch Officer	Mitchell	Goulard	Ouellette
Chief Controller	Larsen	Powers	Mantel
Controller	Murray	Jagger	Necpal
Assistant Controller	Schooner/Brant	Davy/Steel	Wolf/Misiurak
Medical Officers	Buckingham/Seary		
DRF Engineers	Sherwood/McDonald		

WATCH SCHEDULE

DAY/DATE	0000-0800	0800-1600	1600-0000
Mon 4 Feb 80	O	B	C
Tue 5 Feb 80	A	C	A
Wed 6 Feb 80	B	A	B
Thu 7 Feb 80	C	B	C
Fri 8 Feb 80	A		

PART II

DIVING OPERATIONS

PART II

DIVING OPERATIONS

2.1 GENERAL

CEDD Test 1-80 (Air Saturation Dive) is to take place over a period of four days utilizing a final storage depth of 15.3 metres with a single excursion dive from storage to a depth of 34 metres.

During the above profile, a sequence of work serials has been scheduled. These taskings include scientific studies, several physical dives in the water section of the DRF complex during which two specific underwater breathing systems will be employed. Normal daily hygiene and husbandry requirements will be observed.

The specific taskings and those responsible for them are outlined in the following subparagraphs.

2.2 SCHEDULE OF EVENTS

Watch Officers are responsible for ensuring that the Schedule of Events (Annex A) as promulgated is initiated and terminated in accordance with the stated timetable. This will require maximum co-ordination among the inside diving subjects, scientific personnel and the outside dive controllers.

2.3 DIVE PROFILE

A schematic drawing of the anticipated dive profile is included as Annex B for reference purposes. All depth changes, rate of changes and the respective times of depth changes are provided.

2.4 DIVE SUBJECTS

Four volunteers from the staff of CFEME have been accepted as the inside diving subjects. They are identified in Annex A. Prior to the start of CEDD Test 1-80, all dive subjects will have successfully completed a full indoctrination and training work-up period which will have covered the procedures and requirements of all task serials as outlined in the Schedule of Events. In addition, all dive subjects will be fully conversant with all DRF Emergency Procedures and the specific response required of each inside individual.

2.5 SCHEDULED DIVE SERIALS

A total of five in-water dive serials have been scheduled for CEDD Test 1-80 during which the dive subjects will be required to carry out simulated underwater work while using both the AGA ACSC semi-closed breathing diving set and the surface supplied Superlite-17 breathing equipment.

Workload simulations during these serials will be accomplished by using the pedal ergometer which shall be pre-set in accordance with the scientific requirements outlined in Annex E.

The Standard Operating Procedure for each diving equipment system is included as Annexes C and D. The sequence of events laid down in each SOP is to be co-ordinated and monitored by the DRF Chief Controller on watch. Outside support personnel and inside dive subjects are required to conform to the specific SOP as outlined.

2.6 DIVING EMERGENCIES

Guidelines on the responsibilities and required actions of various personnel should an emergency occur during the conduct of an in-water dive serial, are included in the SOP on the equipment in use.

ANNEX A
TO PART II
CEDD TEST 1-80

SCHEDULE OF EVENTS

SERIAL #	DATE/TIME	EVENT	ACTION	REFERENCE
0001	04 1200	Pressurize (9m)	Watch B/all subjects	PART II
0002	04 1205	Emergency Drills	Watch B/all subjects	DRF Emergency Procedures
0003	04 1300	Dive Preps	Watch B/all subjects	PART II
0004	04 1330	Dive #1	Watch B/all subjects	PART II
	04 1445	End Dive #1	Watch B/all subjects	
0005	04 1500	Post-dive Clean-up	Watch B/all subjects	
0006	04 1600	Commence Experiment #1	Watch C/all subjects	PART VI
	04 1700	End Experiment #1	Watch C/all subjects	
0007	04 1700	Free Time	All subjects	
0008	04 1750	Supper	Watch C/all subjects	
	04 1900	Supper ends	All subjects	
0009	04 1900	Clean-up	All subjects	
	04 1925	End Clean-up	All subjects	
0010	04 1925	Medical Checks	Watch C/M.O./All subjects	
0011	04 1935	Ear Prophylaxis	Watch C/M.O./All subjects	PART V
0012	04 1945	Commence Movie	Watch C/all subjects	
	04 2145	Movie ends	Watch C/all subjects	
0013	04 2145	Sleep Preparation	Watch C/all subjects	

ANNEX A
TO PART II
CEDD TEST 1-80

SERIAL #	DATE/TIME	EVENT	ACTION	REFERENCE
0014	04 2230	Out Lights	Watch C/all subjects	
0015	05 0630	Wakey, Wakey	Watch A/all subjects	
0016	05 0700	Medical Checks	Watch A/all subjects/ M.O.	
0017	05 0720	Ear Prophylaxis	Watch A/all subjects/ M.O.	PART V
0018	05 0730	Breakfast	Watch A/all subjects	
	05 0830	Breakfast ends	Watch C/all subjects	
0019	05 0830	Dive Preps	Watch C/all subjects	PART II
0020	05 0900	Commence Dive #2	Watch C/all subjects	PART II
	05 1000	End Dive #2	Watch C/all subjects	
0021	05 1000	Post-dive Clean-up	Watch C/all subjects	
0022	05 1030	Commence Experiment #2	Watch C/all subjects	PART VI
	05 1200	End Experiment #2	Watch C/all subjects	
0023	05 1200	Pressurize (15.3m)	Watch C/all subjects	PART II
0024	05 1205	Lunch	Watch C/all subjects	
	05 1315	Lunch ends	Watch C/all subjects	
0025	05 1315	Dive Preps	Watch C/all subjects	PART II
0026	05 1400	Commence Dive #3	Watch C/all subjects	PART II
	05 1530	End Dive #3	Watch C/all subjects	
0027	05 1530	Post-dive Clean-up	Watch C/all subjects	
0028	05 1600	Commence Experiment #3	Watch A/all subjects	PART VI
	05 1750	End Experiment #3	Watch A/all subjects	
0029	05 1750	Supper	Watch A/all subjects	

ANNEX A
TO PART II
CEDD TEST 1-80

SERIAL #	DATE/TIME	EVENT	ACTION	REFERENCE
	05 1900	Supper ends	Watch A/all subjects	
0030	05 1900	Clean-up	All subjects	
	05 1925	Clean-up ends	All subjects	
0031	05 1925	Medical Checks	Watch A/all subjects/ M.O.	
0032	05 1935	Ear Prophylaxis	Watch A/all subjects/ M.O.	PART V
0033	05 1945	Commence Movie	Watch A/all subjects	
	05 2145	Movie ends	Watch A/all subjects	
0034	05 2145	Sleep Preparation	Watch A/all subjects	
0035	05 2230	Out Lights	Watch A/all subjects	
0036	06 0630	Wakey, Wakey	Watch B/all subjects	
0037	06 0700	Clean-up	Watch B/all subjects/	
0038	06 0720	Ear Prophylaxis	Watch B/all subjects M.O.	PART V
0039	06 0730	Breakfast	Watch B/all subjects	
	06 0830	Breakfast ends	Watch A/all subjects	
0040	06 0830	Dive Preps	Watch A/all subjects	PART II
0041	06 0900	Pressurize (34m)	Watch A/all subjects	PART II
0042	06 0910	Commence Dive #4	Watch A/all subjects	PART II
	06 1010	End Dive #4	Watch A/all subjects	
0043	06 1010	Post-dive Clean-up	Watch A/all subjects	

ANNEX A
TO PART II
CEDD TEST 1-80

SERIAL #	DATE/TIME	EVENT	ACTION	REFERENCE
0044	06 1030	Commence Experiment #4	Watch A/all subjects	PART VI
	06 1155	End Experiment #4	Watch A/all subjects	
0045	06 1200	Depressurize (15.3m)	Watch A/all subjects	PART II
0046	06 1202	Doppler Monitor	Watch A/all subjects/ M.O.	PART VI
0047	06 1215	Lunch	Watch A/all subjects	
	06 1330	Lunch ends	Watch A/all subjects	
0048	06 1330	Doppler Monitor	Watch A/all subjects M.O.	PART VI
0049	06 1400	Dive Preps	Watch A/all subjects	PART II
0050	06 1430	Commence Dive #5	Watch A/all subjects	PART II
	06 1530	End Dive #5	Watch A/all subjects	
0051	06 1530	Post-dive Clean-up	Watch A/all subjects	
0052	06 1600	Commence Experiment #5	Watch B/all subjects	PART VI
	06 1750	End Experiment #5	Watch B/all subjects	
0053	06 1750	Supper	Watch B/all subjects	
0054	06 1800	Depressurize (10m)	Watch B/all subjects	PART II
0055	06 1830	Depressurize (9m)	Watch B/all subjects	PART II
	06 1900	Supper ends	Watch B/all subjects	
0056	06 1900	Clean-up	Watch B/all subjects	
0057	06 1920	Depressurize (8m)	Watch B/all subjects	PART II
0058	06 1925	Medical Checks	Watch B/all subjects/ M.O.	

ANNEX A
TO PART II
CEDD TEST 1-80

SERIAL #	DATE/TIME	EVENT	ACTION	REFERENCE
0059	06 1935	Ear Prophylaxis	Watch B/all subjects/	PART V
0060	06 1945	Commence Movie	Watch B/all subjects	
0061	06 2025	Depressurize (7m)	Watch B/all subjects	PART II
0062	06 2135	Depressurize (6m)	Watch B/all subjects	PART II
	06 2145	Movie ends	Watch B/all subjects	
0063	06 2145	Sleep Preparation	Watch B/all subjects	
0064	06 2250	Depressurize (5m)	Watch B/all subjects	PART II
0065	06 2300	Out Lights	Watch B/all subjects	
0066	07 0630	Wakey, Wakey	Watch C/all subjects	
0067	07 0700	Depressurize (4m)	Watch C/all subjects	PART II
0068	07 0700	Clean-up	Watch C/all subjects/	
0069	07 0720	Ear Prophylaxis	Watch C/all subjects/ M.O.	PART V
0070	07 0730	Breakfast	Watch C/all subjects	
0071	07 0830	Depressurize (3m)	Watch B/all subjects	PART II
	07 0830	Breakfast ends	Watch B/all subjects	
0072	07 0830	Clean-up Doppler Monitoring	Watch B/all subjects	
0073	07 0930	Commence Experiment #6	Watch B/all subjects	PART VI
0074	07 1010	Depressurize (2m)	Watch B/all subjects	PART II
	07 1130	End Experiment #6	Watch B/all subjects	
0075	07 1130	Doppler Monitoring and Preps for Surfacing	Watch B/all subjects	PART VI

ANNEX A
TO PART II
CEDD TEST 1-80

SERIAL #	DATE/TIME	EVENT	ACTION	REFERENCE
0076	07 1200	Depressurize (Surface)	Watch B/all subjects	PART II
0077	07 1200	Doppler Monitoring	Watch B/all subjects	PART VI
0078	07 1202	On the Surface	Watch B/all subjects	
0079	07 1202	Commence 6 hrs DCS Watch	Watch B/all subjects	PART I
0080	07 1205	Exit DDF	Watch B/all subjects	
0081	07 1230	Medicals and Doppler Monitoring	M.O./all subjects	PART VI
0082	07 1230	Lunch	All subjects	
	07 1330	Lunch ends	All subjects	
0083	07 1330	Doppler Monitoring	M.O./all subjects	PART VI
0084	07 1330	Subjects to Clean	All subjects	
0085	07 1430	Subject Debrief	All subjects	
0086	07 1802	End 6 hr DCS Watch	Watch C/all subjects	PART I
0087	07 1802	Commence 12-hr DCS watch. Subjects and Watch leave DCIEM.	Watch C/all subjects	PART I
0088	08 0602	End 12-hr DCS Watch	Watch A/all subjects	PART I

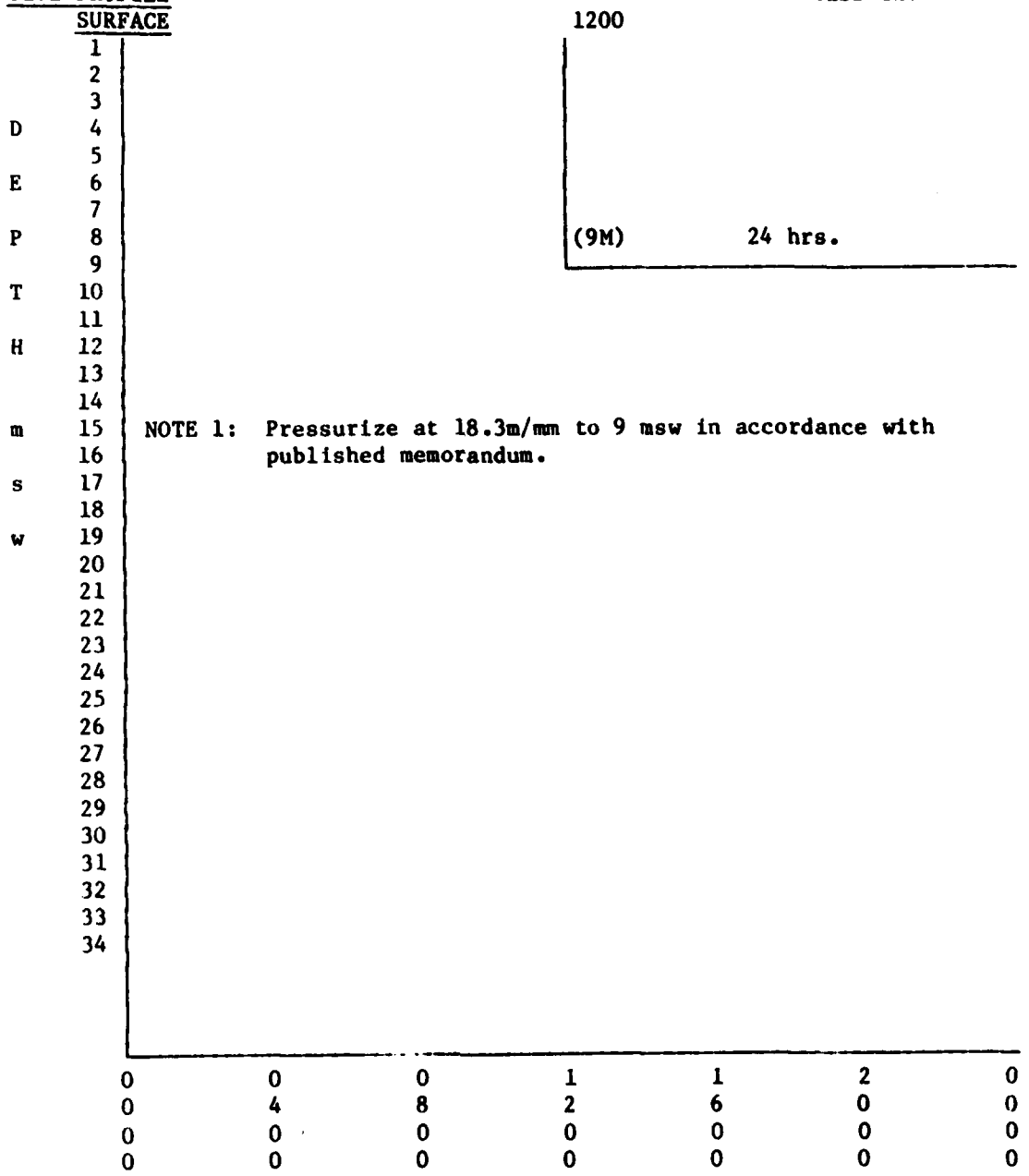
NOTE: A separate memorandum will be issued detailing the exact time and method of pressurizing/depressurizing chambers and will be posted next to the Dive Profile in a prominent position.

2. Dive subjects are as follows:

Lt M.D. Kooner RN - Team Leader
Capt J. Porlier
MCpl Y. Lessard
MCpl N. Regier

ANNEX B
TO PART II
CEDD TEST 1-80

DIVE PROFILE



NOTE 1: Pressurize at 18.3m/mn to 9 msw in accordance with published memorandum.

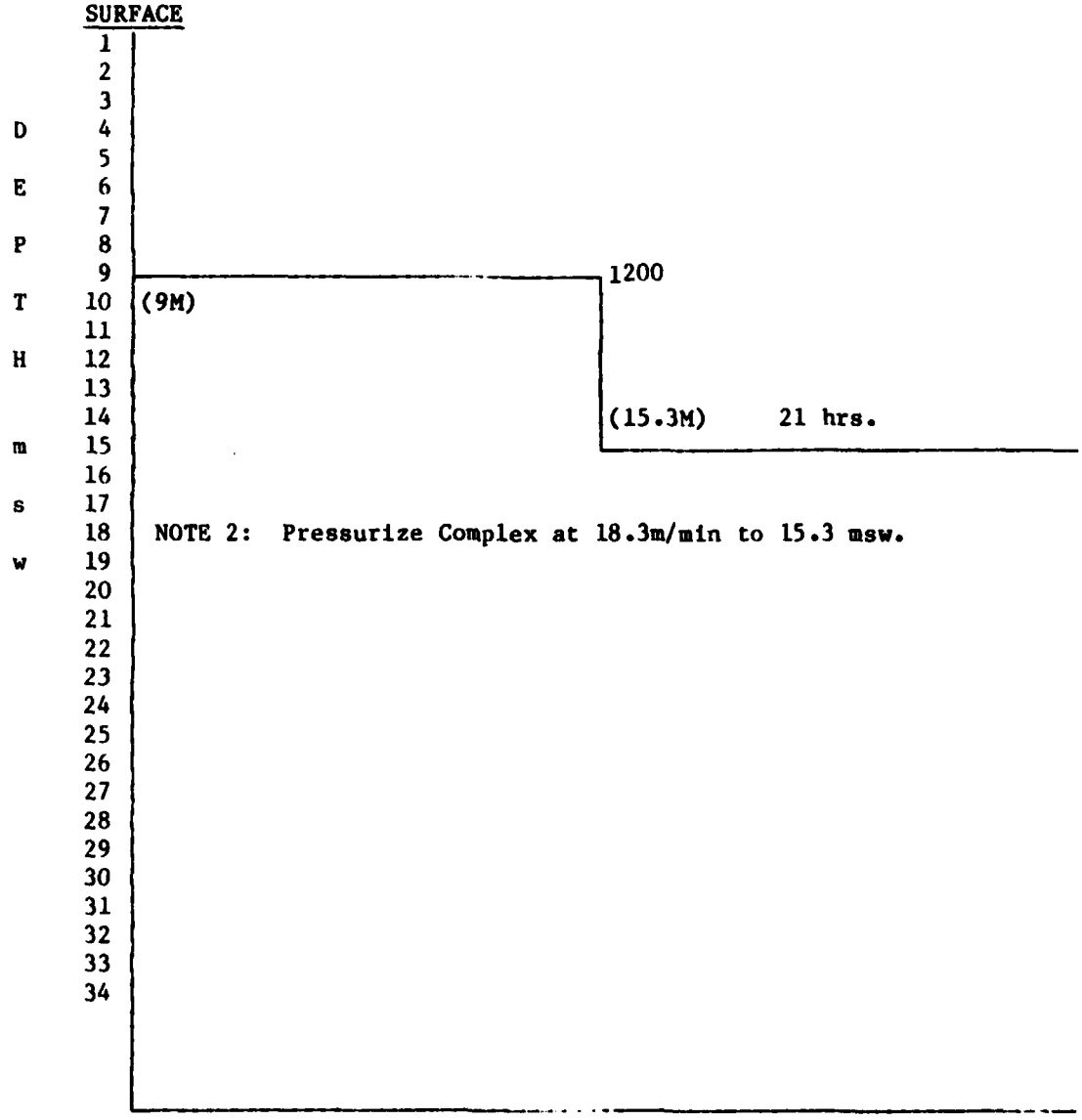
0	0	0	1	1	2	0
0	4	8	2	6	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

DAY 1

MONDAY, 4 FEB 80

ANNEX B
TO PART II
CEDD TEST 1-80

DIVE PROFILE



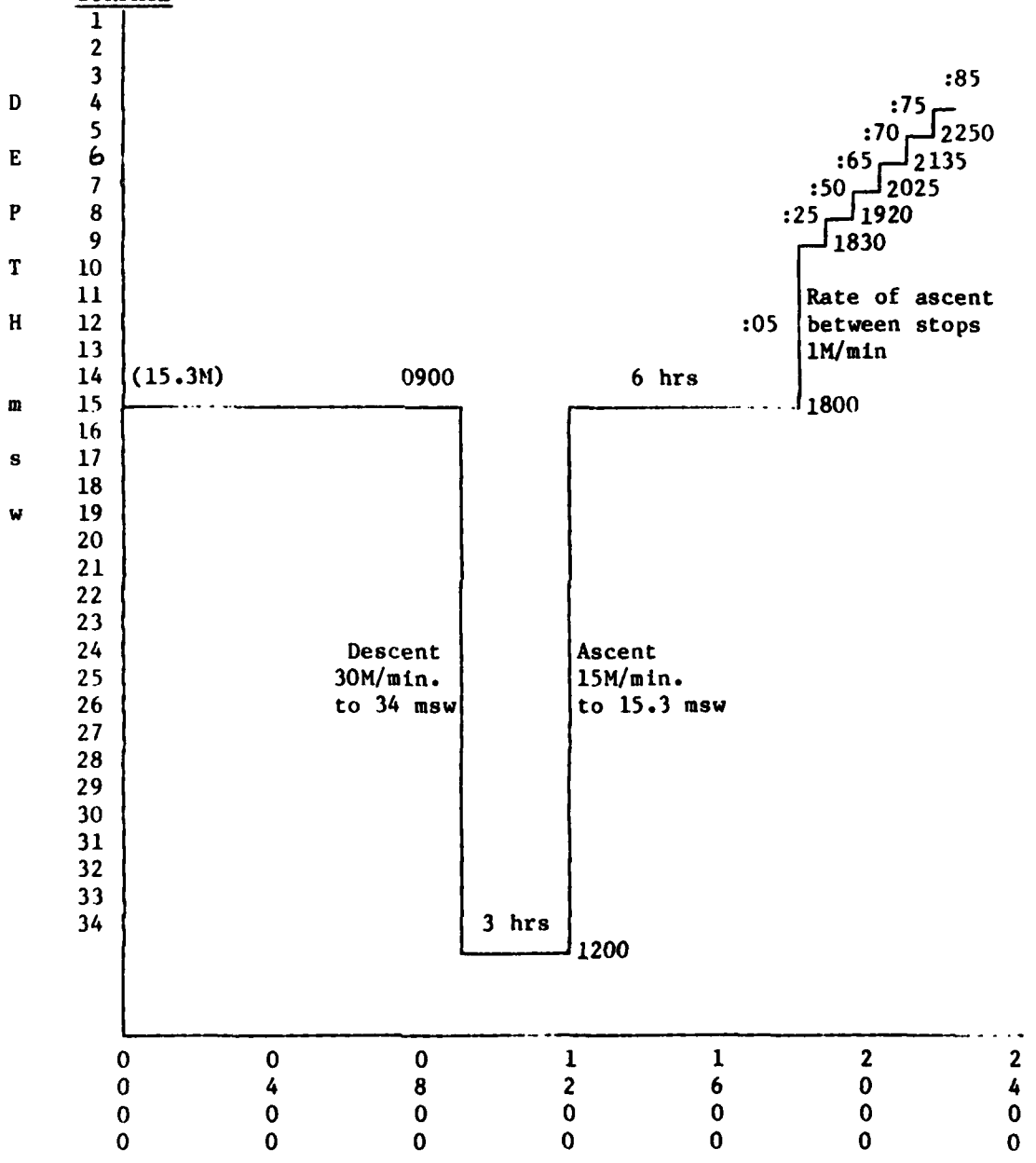
NOTE 2: Pressurize Complex at 18.3m/min to 15.3 msw.

DAY 2

TUESDAY, 5 FEB 80

ANNEX B
TO PART II
CEDD TEST 1-80

DIVE PROFILE

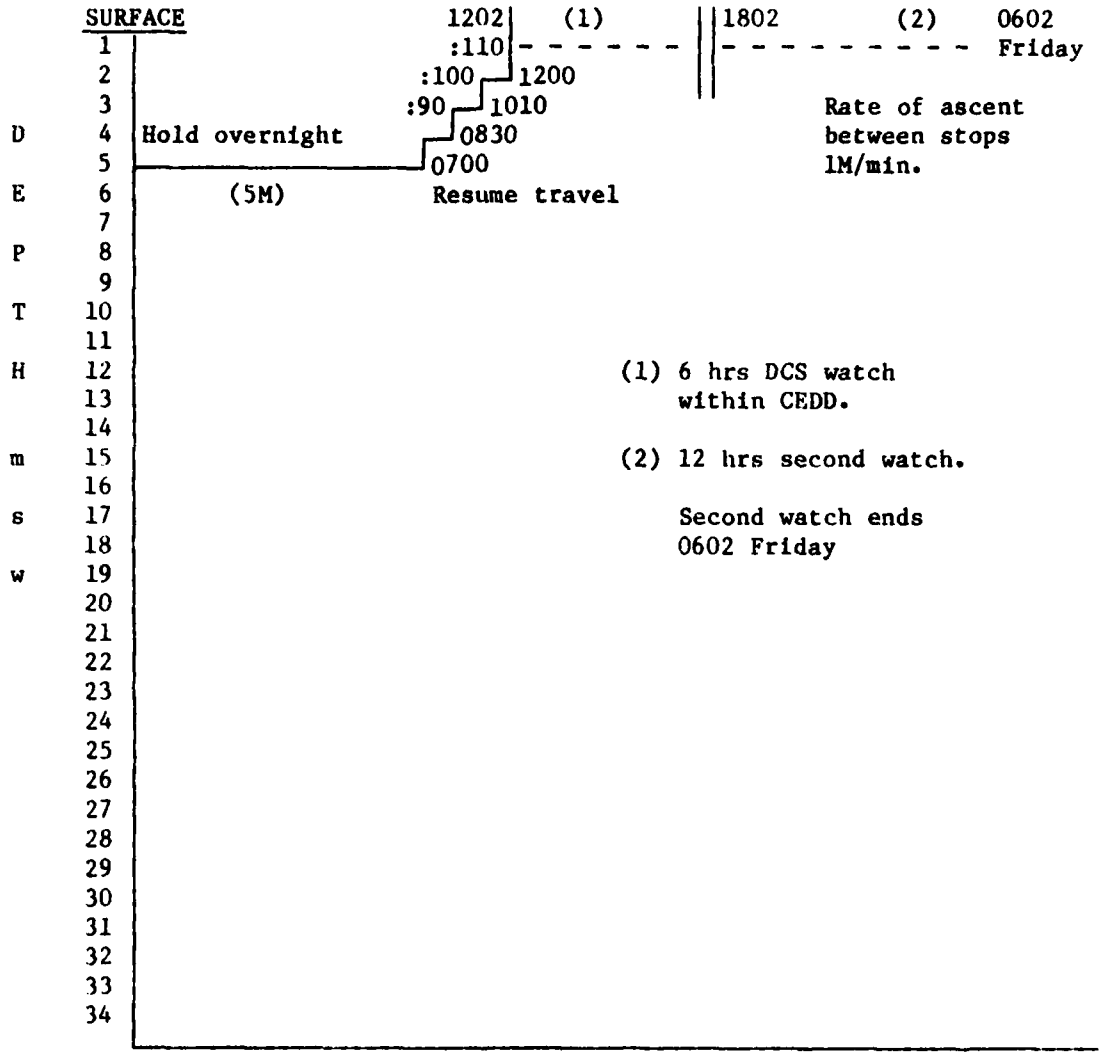


DAY 3

WEDNESDAY, 6 FEB 80

ANNEX B
TO PART II
CEDD TEST 1-80

DIVE PROFILE



DAY 4

THURSDAY, 7 FEB 80

ANNEX C
TO PART II
CEDD TEST 1-80

AGA "ACSC"/WET SUIT

STANDARD OPERATING PROCEDURES (SOP)

1. GENERAL

This SOP has been programmed into nine stages as follows:

a. Time Schedule;

b. Required Equipment;

c. Pre-dive Equipment Checks;

d. Dressing Procedure;

e. In-water Checks;

f. Diver Emergencies;

g. Diver Tasking;

h. Undressing Procedure;

j. Post-dive Equipment Procedures.

a. Time Schedule

Thirty minutes prior to commencement of a dive serial, detailed topside personnel will assemble all necessary diving and support equipment (in accordance with the equipment list) in close proximity to the DRF ready for locking into the complex.

ELAPSED TIME	EVENT	OPI
-30 - 0	All equipment required assembled adjacent to DRF lock-in area.	Topside
0 - 5	Lock in equipment.	
5 - 25	Pre-dive checks.	

ANNEX C
TO PART II
CEDD TEST 1-80

ELAPSED TIME	EVENT	OPI
25 - 35	Dressing Procedure In-water Checks Diver Emergency Procedures Diver Tasking	
0 - 5	Diver exits water	
5 - 15	Undressing Procedures	
15 - 25	Post-dive Procedures	
25 - 30	Equipment Lockout Equipment Clean-up	

b. Required Equipment (Assistant Controllers)

	QUANTITY	ITEM
Diver Subject	1	CO_2 canister (prepacked)
	1	Supply cylinders (charged to 200 bars with 46% O_2 54% N_2 mix)
	1	Full face mask and breathing hoses (anti-mist applied)
	1 pr	*Weighted diving boots*
	1	Chest weights
	Subjects	Wet suit jumper
	Subjects	Wet suit pants
	Subjects	Wet suit hood
	Subjects	Wet suit booties
	1 pr	Wet suit gloves/mitts
	1	Scientific package (see contents list) (telemetry unit cap to be removed)
	1	Diver Tool Kit (see contents list)
Stand-by Diver	1	Air cylinder and backpack
	1	Weight belt
	1	Face mask
	1 pr	Weighted diving boots
	1	Mk V Scubapro Regulator complete
	Stand-bys	Wet suit jumper
	Stand-bys	Wet suit hood
	Stand-bys	Wet suit booties
	1 pr	Wet suit gloves/mitts
	1	Breathing Hose (free) and face mask may be locked in, in case of full face mask problems.

ANNEX C
TO PART II
CEDD TEST 1-80

c. Pre-dive Equipment Checks (Tenders and Diver confirmed by Chief Controller)

(1) Remove cover;

(2) Loosen transportation fastening;

(3) Check colour code on supply cylinder (red banded);

(4) Check colour code on gas accumulator;

(5) Connect supply cylinder;

(6) Bend accumulator tube upwards;

(7) Check that CO_2 absorber cartridge is fitted correctly and that there is no absorbent in the centre tube;

(8) Check "O" ring on cartridge seat;

(9) Insert CO_2 canister (ensure that it is seated over "O" ring;

(10) Fit canister lid and secure;

(11) Check that bypass is working;

(12) Check warming time (50-60 seconds);

(13) Check for correct dosage. Two complete bellows movements. Check with hand over regulator cover for dosage flow;

(14) Check non-return uni-directional valves in breathing hoses;

(15) Adjust nose-clearing device (if fitted);

(16) Fit breathing hoses, ensuring that sampling lines are attached;

(17) Close breathing valve;

(18) Check for leakage in system. Inflate bellows and watch for deflation;

(19) Check over - pressure valve. Compress bellows;

(20) Check for negative pressure leaks. Short bypass. Depress bellows. Lift and tilt so that bellow weights take over;

(21) Check reserve valve:

(A) Close cylinder,

(B) Inflate with bypass,

(C) Check that monometer does not fall below 20 bars;

(22) Check warning system by opening the breathing valve slowly. Bellows should deflate slowly.

(23) Release reserve valve. Manometer should drop to pressure less than 20 bars;

(24) Reset reserve valve (IMPORTANT);

(25) Close breathing valve;

(26) Check carrier apparatus "O" rings.

(27) Fit cover.

d. Dressing Procedure

(1) Apply scientific sensors. Check for functioning. (Telemetry unit cap on and secured).

(2) Stand-by diver shall commence dressing;

(3) Dress diving subject in wet suit;

(4) Put on weight boots;

(5) Put on carrier frame (and accessory weights if required);

(6) Open cylinder supply valve. Check pressure (160 bar minimum);

(7) Place set on diver's back and don face mask;

(8) Confirm that scientific sensors are functioning;

(9) Inflate bellows;

(10) Check that diver can reach bypass valve and reserve valve;

(11) Check manometer pressure.

e. In-water Checks

(1) Stand-by diver shall proceed over barrier as directed by topside control and check function of equipment;

(2) Diving subject shall proceed over barrier as directed by topside control;

(3) Diver shall immerse and check for equipment leaks;

(4) Confirm mass spectrometer functioning;

(5) Proceed as directed.

f. Diver Emergencies

Should the diver have any difficulties during his dive, he should use the bypass valve as required and, if necessary, activate the reserve valve. He should proceed under the barrier as quickly as possible and stand erect in the shallow area of the water section to enable his tenders to render assistance.

The tender should monitor the diver continuously throughout the dive for any visible difficulties, bearing in mind that the diver has no voice communication with the surface or his tenders. Should the diver appear to be in difficulty the tender is to:

(1) call out "Diver Emergency",

(2) Dispatch the stand-by diver to render assistance,

(3) Report all events and their resolution to topside control.

NOTE: The stand-by diver is to be fully dressed except for mask and be forward of the low barrier where he may rest on the entrance ladder platform.

g. Diver Tasking

In accordance with Annex E.

h. Undressing Procedure

(1) Remove diver's mask (being careful not to flood sensing tubes) and close breathing valve;

(2) Diver shall release locking mechanism;

(3) Remove set;

(4) Remove carrier frame;

(5) Remove boots;

(6) Remove suit;

(7) Remove scientific sensors.

j. Post-dive Equipment Procedures

(1) Disconnect mask and breathing hoses from set;

(2) Open CO_2 absorbent canister lid;

(3) Remove CO_2 absorbent cartridge noting any excess moisture in canister cavity;

(4) Shut off supply cylinder valve; disconnect supply cylinder and remove from set;

(5) Place breathing set in vertical position and flush with fresh water. Wipe off excess water;

(6) Leave set in vertical position to drain and dry;

(7) Diving subjects shall carry out ear prophylaxis in accordance with Part V;

(8) Prepare to lock out the following equipment:

Personal wet suits
CO_2 cartridge
AGA gas cylinder
Scientific Monitoring Package (telemetry unit cap removed)
Stand-by cylinder if charging required
AGA mask and hoses.

2. TOPSIDE

a. Empty CO_2 absorbent canister and flush with fresh water;

b. Place absorbent pads in a suitable drying environment;

c. Recharge supply cylinder with appropriate 46% O_2 54% N_2 mixture;

d. Hang all diving suits and other equipment in a suitable drying area;

e. Wash and wipe out AGA mask and clean with mild solution of Savalon.

ANNEX D
TO PART II
CEDD TEST 1-80

SUPERLITE 17/WET SUIT

STANDARD OPERATING PROCEDURES (SOP)

1. GENERAL

This SOP has been programmed into nine stages as follows:

a. Time Schedule;

b. Required Equipment List;

c. Pre-dive Equipment Checks;

d. Dressing-in Procedure;

e. In-water Checks;

f. Diver Emergency Procedures;

g. Diver Tasking;

h. Undressing Procedures;

j. Post-dive Equipment Procedures.

1. The sequence of events laid down in this SOP are to be co-ordinated and monitored by the DRF Chief Controller on watch. Outside support personnel and inside dive subjects are required to conform to this SOP as outlined.

a. Time Schedule

Thirty minutes prior to the start of the dive serial, topside personnel (as detailed) are to assemble all required diving equipment (in accordance with the equipment list) in close proximity to the DRF ready for locking into the DRF complex. Particular attention should be given to ensuring that suits and helmet liner sizes are compatible with the scheduled diving subjects.

ELAPSED TIME	EVENT	OPI
-30 - 0	Assemble equipment	Topside
0 - 5	Lock equipment into chamber	Chief Controller
5 - 15	Pre-dive checks	Tenders/Divers

ANNEX D
TO PART II
CEDD TEST 1-80

ELAPSED TIME	EVENT	OPI
15 - 25	Dressing-in Procedure	Tender/Divers
25 - 30	In-water Checks	Chief Controller
30 -	Diver Tasking	Chief Controller
0 - 5	Diver Exits Water	Chief Controller
5 - 15	Undressing Procedures	
15 - 35	Post-dive Procedures	
As required	Equipment Clean-up	

b. Equipment List (Assistant Controllers)

	QUANTITY	ITEM
Diver Subject	1	Superlite-17 Helmet (with anti-mist applied)
	1	Helmet liner
	1	Helmet neck band and clamp
	1	Emergency backpack cylinder (charged with air 2000 psi min.)
	1	First stage regulator (Conshelf Mk 12)
	1	Quick-disconnect whip (2 piece)
	Subject	Wet suit jumper
	Subject	Wet suit pants
	Subject	Wet suit hood
	Subject	Wet suit booties
	Subject	Wet suit mitts
	1 pr	Weighted diving boots
	1	Weighted vest
	1	Scientific monitoring package (telemetry unit cap removed) (see contents list)
	1	Diver Tool Kit (see contents list)
Stand-by Diver	1	Face mask
	1	Weight belt
	1 pr	Weighted diving boots
	1	Air cylinder and backpack (charged 2000 psi min.)
	1	Mk V Scubapro regulator
	Stand-bys	Wet suit jumper

Stand-bys	Wet suit pants
Stand-bys	Wet suit hood
Stand-bys	Wet suit booties
Stand-bys	Wet suit mitts

c. Pre-dive Equipment Checks (Tenders and Divers confirmed by Chief Controller)

(1) Inspect all rubber and moulded plastic components for damage;

(2) Inspect all metal components for loose mounting bolts, excessive dents or damage;

(3) Check nose clearing device;

(4) Fit earphones into head liner side pockets and connect microphone to applicable connection of preamp unit;

(5) Ensure that headliner and oral-nasal mask are properly attached;

(6) Check neck clamp for:

(A) lock-nut adjustment,

(B) locking tension,

(C) interior neck seal.

(7) Check non-return valve by removing it from side block. Check for correct function. No leaks permissible. Replace in side block.

(8) Connect air umbilical to non-return valve;

(9) Connect computer readout sensing hose;

(10) Connect communication plugs to internal DRF communications box;

(11) Ensure that umbilical is connected to diving manifold outlet;

(12) Gauge backpack cylinder (minimum 2000 psi);

(13) Fit first stage Conshelf Mk 12 regulator on backpack cylinder;

(14) Fit quick-disconnect whip to first stage regulator;

(15) Fit quick-disconnect (second piece) to helmet side-block assembly;

(16) Outside Control shall ensure that air is on line to both A and B BIBS manifolds in dive chamber.

(17) Close cross-connect valve for A to B manifold HP line;

(18) Close diver's umbilical cross-connect;

(19) Ensure that alternate supply outlet is capped;

(20) Open both divers' supply valves;

(21) Adjust both Tescom regulators to read 180 psi;

(22) Confirm that there is gas flow on freeflow valve;

(23) Confirm that there is adequate flow on purge valve;

(24) Confirm communications with DRF Control Console;

(25) Ensure that scientific monitoring penetration is correct and connected.

d. <u>Dressing-in Procedure</u>

(1) Attach scientific monitoring sensors to diver and confirm that they are working properly;

(2) Dress diving subject in personal wet suit;

(3) Stand-by diver shall commence dressing;

(4) Put on weighted diving boots;

(5) Put on neck band complete with helmet retainer;

(6) Put on weight vest with backpack in place;

(7) Place helmet over diver's head;

(8) Clamp helmet to neck band;

(9) Connect emergency backpack quick-disconnect whip. Open backpack cylinder valve fully (ensure that reserve valve if fitted is in down position);

(10) Secure umbilical snap hook to weight vest;

(11) Confirm diver communications with inside tender and topside control;

(12) Put on diving gloves (if required).

e. <u>In-water Checks</u>

(1) Stand-by diver shall proceed over barrier as directed by topside and check function of equipment;

(2) Subject diver shall proceed over barrier as directed by topside;

(3) Check purge valve for function and flow;

(4) Check steady flow valve for flow;

(5) Adjust second stage regulator adjustment valve;

(6) Tender shall inform diver and close diver's umbilical supply valve;

(7) Bleed umbilical pressure down;

(8) Open emergency valve;

(9) Test emergency system (Purge and free-flow valves activated);

(10) Close emergency valve;

(11) Open diver's umbilical supply valve;

(12) Immerse diver and check for leaks in system;

(13) Report to topside, "diver ready for tasking".

(14) Ensure that scientific monitors are ready for tasking.

f. Diver Emergency Procedures

Any difficulty experienced by the diver is to be passed via the communications net. If necessary, the diver should activate his emergency breathing system and proceed forward of the barrier.

If tender observes that diver is in difficulty, he will immediately communicate this to topside control and take the following action:

(1) Call out, "Diver Emergency!";

(2) Direct stand-by diver to proceed under barrier and render assistance as required;

(3) Inside personnel should endeavour to keep topside control informed of events and any problems that may arise.

NOTE: Stand-by diver is to be fully dressed except for face mask and to be forward of the first barrier where he may rest on the top step of the entrance ladder.

g. Diver Tasking

Tasking to be in accordance with Annex E.

h. Undressing Procedures

(1) Diver stands up close to low barrier;

(2) Release clamp and remove helmet;

(3) Shut umbilical supply valve and bleed umbilical;

(4) Close emergency backpack cylinder valve;

(5) Bleed emergency air system;

(6) Undo quick-disconnect whip;

(7) Unsnap umbilical from weight vest;

(8) Diver shall proceed over low barrier;

(9) Remove weight vest and weights;

(10) Remove weighted boots;

(11) Remove wet suit;

(12) Remove scientific monitoring package;

(13) Assemble equipment for locking out of DRF.

j. Post-dive Procedures

(1) Inside Subjects

(A) Disconnect umbilical and communications and computer sensor lines from helmet;

(B) Gauge stand-by and diving subject's backpack cylinders (2000 psi minimum);

(C) Lockout following equipment: personal wet suits, Superlite helmet and liners, cylinders that require recharging, scientific monitoring package, and any equipment requiring repair. (Telementry unit cap removed).

(D) Diving subjects perform ear prophylaxis in accordance with Part V.

(2) Topside Personnel

(A) Remove helmet liner and hang up to dry;

(B) Wipe out inside of helmet and clean oral nasal mask with mild solution of Savalon;

(C) Inspect helmet for damage;

(D) Charge backpack cylinder to 2000 psi minimum (if required);

(E) Hang diving suits to dry in assigned area;

(F) Have scientific sensors serviced as necessary.

ANNEX E
TO PART II
CEDD TEST 1-80

DIVE SUBJECT SCHEDULE

1. All dives are to be carried out in accordance with the appropriate SOP's and and the subjects named are to fill the positions as listed below.

2. Ergometer workloads for all divers will be as shown below; however, the individual pre-set maximum load for each individual will be assessed prior to the commencement of the dive.

DIVE #	NAME	FUNCTION	EQUIPMENT	OBJECTIVE
1	Lessard	Diver	AGA/Wet suit	Ergometer work
	Porlier	Stand-by Diver	Scuba/Wet suit	Stand-by diver
	Regier	Diver Tender		
	Kooner	Stand-by Diver Tender		INSIDE SUPERVISOR
2	Regier	Diver	Superlite-17/ Wet Suit	Ergometer work
	Kooner	Stand-by Diver	Scuba/Wet suit	Stand-by diver
	Porlier	Diver Tender		
	Lessard	Stand-by Diver Tender		INSIDE SUPERVISOR
3	Porlier	Diver	AGA/Wet suit	Ergometer work
	Lessard	Stand-by Diver	Scuba/Wet suit	Stand-by diver
	Regier	Diver Tender		
	Kooner	Stand-by Diver Tender		INSIDE SUPERVISOR
4	Kooner	Diver	Superlite-17/ Wet Suit	Ergometer work
	Regier	Stand-by Diver	Scuba/Wet suit	Stand-by diver
	Porlier	Diver Tender		
	Lessard	Stand-by Diver Tender		INSIDE SUPERVISOR
5	Lessard	Diver	AGA/Wet suit	Ergometer work
	Porlier	Stand-by Diver	Scuba/Wet suit	Stand-by diver
	Regier	Diver Tender		
	Kooner	Stand-by Diver Tender		INSIDE SUPERVISOR

3. Ergometer Workloads (Set in Watts)

a. rest for 5 min;

b. 50 for 5 min;

c. rest for 5 min;

d. 75 for 5 min;

e. rest for 5 min.;

f. 100 for 5 min;

g. rest for 5 min;

h. max. for 5 min;

j. rest for 5 min;

k. repeat items a. to j.

PART III

HYPERBARIC FACILITY OPERATIONS

PART III

HYPERBARIC FACILITY OPERATIONS

3.1 DRF WATCHKEEPING PERSONNEL

The watchkeeping personnel will be members of the Diving Division (CEDD) and selected participants from other units.

There will be three watches and each watch will comprise the following positions:

a. Watch Officer;

b. Chief Controller;

c. Controller; and

d. Assistant Controller.

Technical engineering and clinical medical support will be available from the Hyperbaric Engineering Section and Medical Section staff on-site on a twenty-four-hour basis.

The duties of all watchkeeping personnel are outlined in "Standard Operating Procedures (SOP's - DCIEM) 3617A-10-2 (D/CEDD) dated 9 Jul 79" contained in Annex A.

The watch officers will be responsible to the Director, Diving Division for the safe and competent operation of the DRF and for ensuring that all serials are carried out as promulgated and in strict compliance with the Dive Profile. Amendments to the Profile will only be authorized by the Director, Diving Division.

An intensive training period will be carried out from 14 Jan - 1 Feb 80 to ensure maximum competence by all concerned personnel in the operation of the DRF, DRF sub-systems and all emergency procedures. A complete training schedule will be promulgated separately and distributed to all affected personnel.

A watchkeeping schedule outlining the manning of positions and tour of duty is contained in Part I, article 1.8 and Annex A to Part I.

3.2 DIVING RESEARCH FACILITY OPERATIONS

To accommodate the "Air Saturation Dive" (CEDD Test 1-80) Protocol, all required DRF sub-systems will be on-line and operated in

accordance with the DRF Operations Manual with amplification in the following areas.

3.2.1 MAIN CONTROL CONSOLES

The main control consoles are to be used during all descent and hold phases of the Dive Profile. Valve setting versus rate of travel curves will be available at the console. Use of the manual console will be required during certain ascent and descent phases to achieve the rates of travel dictated by the Dive Profile. The proper procedure for sequential use of the main and manual control consoles is to be addressed during the pre-dive training period.

3.2.2 ENVIRONMENTAL CONTROL CONSOLE

The environmental control console will be manned to monitor, maintain and log the partial pressure of oxygen and carbon dioxide, as well as temperature and relative humidity in accordance with the following laid down parameters.

3.2.3 OXYGEN

In view of the fact that air is the pressurization and breathing medium, the maximum PO_2 (based on 21% O_2) at the respective Hold, Storage and Excursion depths will be:

DEPTH	MAX PO_2 BARS ABS.	PO_2 MONITOR/CONTROLLER SETTINGS (mmHg) SET POINTS	HIGH ALARM	LOW ALARM
0 msw	0.21	157	N/A	N/A
2 msw	0.25	189	198	180
3 msw	0.27	204	214	194
4 msw	0.29	220	231	209
5 msw	0.31	237	248	226
6 msw	0.33	252	264	240
7 msw	0.35	268	281	255
8 msw	0.37	284	298	270
9 msw	0.4	300	314	286
10 msw	0.42	315	330	300
15.3 msw	0.53	401	420	382
34 msw	0.92	696	729	663

Slight deviations in the PO_2 readout are to be expected and are acceptable. A copy of the above table will be posted at the Environmental Control Console along with the procedure to follow for altering the setting when changing depth.

The hyperbaric operational staff will ensure that sufficient oxygen is available to satisfy the requirements of the Dive Protocol.

3.2.4 CARBON DIOXIDE

In chambers 11mHg (1.5% CO_2) is acceptable for periods up to 15 min. During the last two hours prior to canister breakthrough or during periods when the activity level in the chamber is high, 7 mmHg (1.0% CO_2) is acceptable for longer periods.

a. Canister Breakthrough

In general, canister breakthrough is approaching when the following readings are obtained:

PCO_2 (chamber) 7mmHg and/or PCO_2 (loop outlet) 1/2 chamber PCO_2.

The Chamber Atmosphere Data Log should be consulted frequently to verify long term PCO_2 trends in the chambers and at the loop outlets. The readings obtained will determine the need to change canisters. Canister changes will be authorized by the Watch Officer and carried out by the Assistant Controllers under the direct supervision of the Controller or Chief Controller. Loop cross-connection and equalization will be addressed under Environmental Control Loops.

3.2.5 TEMPERATURE

Owing to the lack of DRF insulation, the chambers will not be actively heated. It is felt that ambient heat will be sufficient to maintain the complex at a comfortable temperature.

3.2.6 RELATIVE HUMIDITY

The relative humidity will be maintained at 60% $\pm$ 10%.

This level will obviously be exceeded in the Dive Chamber when it is not in use and the loop to the chamber is isolated. The same will be true in the Transfer Sphere when subjects are using the shower. No difficulty is anticipated in remaining within limits at all other times.

3.3 ENVIRONMENTAL CONTROL LOOPS

The Environmental Control Loops (ECL) will be on-line to maintain the desired levels of carbon dioxide and relative humidity for the removal of trace contaminants as necessary. Loop alignments required to maintain these levels will be determined by the Watch Officer. Close scrutiny of the Chamber Atmosphere Data Log should be maintained in order to predict trends. The cross-connecting or equalizing of loops must be authorized by the Watch Officer and carried out either by him or the Chief Controller.

The key to the valve controlling the 120 psi instrument air to the loop cross-connect panel will be under the direct control of the Watch Officer. When it becomes necessary to cross-connect loops (i.e. putting canister No. 1 of the Living Chamber (L/C) loop containing the molecular sieve and activated charcoal on-line to the Transfer Sphere (T/S) to remove trace contaminants from the T/S the Watch Officer, or Chief Controller if delegated by the Watch Officer, will align the necessary valves on the cross-connect panel and totally reassure himself that the planned cross-connection is correct prior to opening the key operated 120 psi instrument air valve. This procedure will be addressed in detail during the pre-saturation dive training period.

E.C.L. STATUS

CHAMBER	CANISTER #1		CANISTER #2		CANISTER #3	
	INNER	OUTER	INNER	OUTER	INNER	OUTER
LIVING CHAMBER	Silica Gel	Molecular Sieve and Activated Charcoal	Soda Lime	Silica Gel	Soda Lime	Silica Gel
TRANSFER SPHERE	Silica Gel	Silica Gel	Soda Lime	Silica Gel		
DIVE CHAMBER	Soda Lime	Silica Gel	EMPTY		EMPTY	

NOTE: The following containers will be filled and ready for insertion:

Outers - 2 Silica Gel

Inners - 1 Soda Lime/1 Silica Gel

The hyperbaric operational staff will ensure that sufficient soda lime and silica gel are readily available to satisfy the requirements of the DRF Protocol.

3.4 BIBS GASES

The hyperbaric operational staff will ensure that the following BIBS gases are available and on-line to the BIBS manifolds in the respective chambers in the case of air, and on-line to the Oxygen Control Console in the case of oxygen.

GAS	DEPTH GAUGE	MAX PO_2 BARS ABS.
21/79 (air)	0 - 34 msw	0.92
37.5/62.5 (O_2 N_2)	0 - 50.3 msw	2.27
37.5/62.5 (O_2 N_2)	0 - 34 msw	1.65
100% O_2	0 - 18.3 msw	2.83

3.5 COMMUNICATIONS AND ENTERTAINMENT CONSOLE

Close control must be maintained over the Communications and Entertainment network. The schedule and allocation of channels for individual events is contained in Annex B. Any deviation from this schedule must be authorized by the Watch Officer.

3.6 UNDERWATER FITTINGS

The underwater ergometer is to be fitted and checks for continuity are to be completed prior to total flooding. These procedures are to be co-ordinated by the DRF operations staff and the Engineering Section.

3.7 DOPPLER MONITORING

Biotechnical staff in co-ordination with CEDD technical staff are to ensure that the Doppler Monitoring System is fitted and functional in all chambers.

3.8 CHAMBER ATMOSPHERE ANALYSIS

Gas samples of the chamber atmosphere will be taken twice daily from the Living Chamber and Transfer Sphere and analyzed for the presence of contaminants. If the analysis indicates the presence of contaminants, the ECL canister containing the molecular sieve and charcoal will be brought on-line for their removal. The approval of the Watch Officer or Chief Controller is necessary prior to the taking of any samples. One of the A/Controllers will be delegated to assist Toxicology personnel in taking the sample.

3.9 TAPE RECORDING

The air saturation dive will be recorded on the Dictaphone Dictalog 4000 in the VOX operation mode. Hyperbaric operations staff will ensure that sufficient tapes are available to satisfy the requirements. Medical checks are confidential and, therefore, are not to be monitored or recorded.

3.10 FIRE PROTECTION

The DRF will be operating in the fire zone throughout the air saturation dive. The enforcement of hyperbaric fire prevention shall be the responsibility of all personnel, watchkeepers and subjects alike. All materials and/or equipment entering the complex shall be approved by the Watch Officer or Chief Controller and shall be appropriately logged in the respective chamber's medical lock log. All items leaving the complex shall likewise be logged. The Hyperbaric Systems Engineer shall certify that all electrical equipment entering the complex is safe and compatible with the hyperbaric environment and the depth at which the equipment will be operated. Subjects'personal effects shall be limited to toothbrush and paste, razor, non-aerosol shaving cream, soap, comb and hair brush, writing material, pencil and a limited amount of reading material.

3.11 LOGS, RECORDS AND PROCEDURES

The following logs, records and procedures shall be maintained at their respective stations in the control room. All events and data shall be recorded as directed.

3.11.1 DIVE PROTOCOL MASTER COPY

A bound copy of the Air Saturation Dive Protocol is to be maintained at the Main Control Console as the MASTER COPY. NO alterations are to be made to it except by the Watch Officer as directed by the Director, Diving Division and in accordance with article 1.6. The Director is to sign and date any alterations. Any changes in other copies will have no validity.

3.11.2 MASTER LOG

An official bound Master Log shall be maintained at the Main Control Console at all times during the dive. This log is to contain a chronological record of all significant events and procedures that take place during the dive. The following items must be logged:

a. Times of occurrences;

b. Narratives of any untoward incidents;

c. Tape recorder counter reading of significant events;

d. Topping up of potable water tanks, emptying of sanitary system holding tank;

e. Ear prophylaxis and medical checks;

f. Changes in alignment, cross-connecting, equalizing or repacking of ECL;

g. All diving/scientific activities including daily barometric pressure and dive-chamber water temperatures;

h. Immediately after being relieved, the Watch Officer is to write on the left-hand page of the log, a brief narrative of events that occurred and observations made during his watch.

j. The duty Diving Medical Officer is to write a narrative on the left-hand page of the log following medical checks and after any consultation for treatment.

NOTE: The above list is not exhaustive.

3.11.3 CHAMBER ATMOSPHERE DATA LOG

The Assistant Controllers shall monitor and record hourly readings of depths, water and chamber temperatures, PCO_2 in the chamber and ECL outlets, chamber PO_2, and chamber R/H. All obvious developing trends will be brought to the immediate attention of the Watch Officer.

3.11.4 ENVIRONMENTAL CONTROL LOOP DATA LOG

The Assistant Controllers shall monitor and record changes in the ECL status as they occur, i.e. canisters on-line and off-line, respective cartridge delta time and total time, and inner and outer cartridge contents.

3.11.5 MEDICAL LOCK LOGS

Each Medical Lock is provided with its own log for recording the date, time and depth of the lock when either leaving the surface or bottom, and items locked in or out. Approval must be obtained from the Watch Officer or Chief Controller prior to the operation of the locks. Likewise, the Watch Officer or Chief Controller will approve all items locked in or out. Particular note is to be made of all combustible material entering the chambers.

3.11.6 DRF SUB-SYSTEMS PRE-DIVE/POST-DIVE CHECK- LISTS

Pre-dive and post-dive check-lists are provided for the change in status of all systems. These check-lists are to be utilized and signed by the operator effecting the change and initialed by either the Watch Officer or Chief Controller. The check-lists are to be completed and signed by the individual carrying out the specific operation. The Chief Controller is to sign the completed form and ensure that it is filed for future reference.

3.11.7 MACHINERY LOG

This log will be maintained to indicate to the hyperbaric engineering staff any day-to-day mechanical, electrical or sub-system problems that have arisen during the respective watches' tours of duty. The log will be checked and signed by the duty DRF engineer at the conclusion of each 8-hour watch. The duty DRF engineer will be notified regarding problems requiring immediate attention.

3.12 EMERGENCY PROCEDURES

Emergency situation procedures have been compiled which are to be put into effect should certain incidents preclude the planned dive profile from being followed. These procedures outline the action to be taken by each member of the watch and by chamber occupants should an emergency situation occur. All watchkeeping personnel and subjects will ensure that they are fully conversant with these procedures prior to the commencement of the air saturation dive. Watch Officers should review emergency routines during the dive. Emergency procedures are simulated during Dive Serial 0002 and subjects should not conduct simulations or become involved in topside training after that Dive Serial.

ANNEX A
TO PART III
CEDD TEST 1-80

STANDARD OPERATING PROCEDURES
(SOP'S - DCIEM)

Ref: A. CFP 380

1. The operation and co-ordination of diving activities utilizing the DCIEM Diving Research Facility (DRF) is the responsibility of the Director, Diving Division. The operating procedures and policies outlined shall be complied with in respect of all dives conducted in the DRF whether they be operational, experimental or for decompression treatment purposes.

2. The dive Protocol previously approved by the Director or, in his absence, the Operations Officer, shall be posted, if possible, a minimum of 12 hours prior to the commencement of any dive. This Protocol shall outline the dive requirements and personnel delegated to those specific tasks requiring attention. The types of diving taking place in the DRF fall into two main categories, each of which will require different numbers of personnel closed up and with varying degrees of expertise.

Category #1

SATURATION DIVING

A minimum of four persons is required to form a "watch" during Saturation Diving Operations. The identified positions and minimum level of expertise required of personnel designated to these positions and their duties are as follows:

a. Watch Officer

Shall either be a qualified MARS 71(D) or civilian equivalent, authorized by the Director to hold such a position.

Responsibilities

Responsible to the CEDD Operations Officer during his assigned watch for the safe operation and control of the DRF complex, the conduct and supervision of all DRF control personnel assigned to his watch and for ensuring that the authorized Dive Protocol is followed during his watch.

b. Chief Controller

Shall be either a Clearance Diver 6B or above, or the civilian equivalent, authorized by the Operations Officer to hold such a position.

Responsibilities

Responsible to the Watch Officer for operating the DRF complex as required from the Chief Controller's position and relieving the Controller in all other positions when delegated by the Watch Officer. As Chief Controller he must be capable of relieving the Watch Officer temporarily as may be required for short periods of time during a watch. The Chief Controller will act as the diving supervisor during any "in water diving" activities in the diving chamber of the DRF complex.

c. Controller

Shall be either a Clearance Diver 5B or above or the civilian equivalent, authorized by the Operations Officer to hold such a position.

Responsibilities

Responsible to the Watch Officer for operating the DRF complex as required from the Controller's position. This may include operating any or all of the following consoles: control, BIBS, or the environmental monitoring console. His duties may include relieving the Chief Controller or the Assistant Controller as delegated by the Watch Officer.

d. Assistant Controller

May be of any military or civilian diving specialization provided he has undergone a course of indoctrination as organized by the Head of the Hyperbarics Group and is authorized by the Operations Officer to hold such a position.

ANNEX A
TO PART III
CEDD TEST 1-80

Responsibilities

Responsible to the Chief Controller for assisting the Controller or Chief Controller to operate the DRF complex as directed. He must have sufficient knowledge of the various DRF sub-systems to enable him, when directed, to perform safely various functions pertinent to a particular sub-system with a minimum of direct supervision.

3. Medical and Engineering support will be provided as outlined in the appropriate protocol.

ANNEX B
TO PART III
CEDD TEST 1-80

COMMUNICATIONS/ENTERTAINMENT

1. The Watch Officer will exercise complete control over the Communication and Entertainment Console.

2. The following channels have been allocated for the various activities:

ACTIVITY	CHANNEL
Diving Operations and General	RED
Scientific Experiment (Pulmonary)	ORANGE
Doppler Monitoring	YELLOW
Medical Interviews	BLUE
Scientific Experiments (Cardiac Output and Tremor)	GREEN
Music and Entertainment	GREY

3. When medical interviews are being conducted, the Watch Officer will ensure that channel 4 to the tape recorder is switched off and that the Medical Officer and the subject being interviewed are the only ones on the blue channel.

PART IV

HYPERBARIC ENGINEERING

PART IV

HYPERBARIC ENGINEERING

4.1 EQUIPMENT STATUS

The equipment status will be comprehensively covered in a separate memorandum issued by the Director, Diving Division prior to the commencement of the dive. This memorandum will be prominently displayed.

4.2 ENGINEERING ROUTINES AND PROCEDURES

These will be carried out in accordance with CEDD Engineering Orders as published. They will be made readily available at the Control Console.

PART V

MEDICAL PROCEDURES

SECTION V

MEDICAL PROCEDURES

5.1 MEDICAL EXAMINATIONS

Prior to the dive, each subject will be examined according to the following protocol:

a. General medical history and physical examination;

b. Chest X-ray;

c. EKG;

d. Audiogram;

e. Pulmonary Function Studies;

f. Skin Thickness Test.

Following the surfacing of the dive, each subject will be re-examined:

a. General physical examination;

b. Audiogram

c. Any additional indicated study.

5.2 EXTERNAL EAR PROPHYLAXIS

In the morning and evening, all subjects will carry out ear prophylaxis; after each wet dive, the dive subjects only, are to irrigate each ear as follows:

a. Tilt head to one side and gently fill the ear canal with Otic Domboro Solution;

b. Leave the solution in the ear canal for five minutes as timed by the watch section;

c. Tilt head to other side and let solution run out of canal;

d. Repeat the procedure in the other ear.

e. Watch section is to observe, time, and log ear prophylaxis.

5.3 DIAGNOSIS AND TREATMENT OF DECOMPRESSION SICKNESS

Although it is improbable, decompression sickness may occur at some point in this dive. While it is likely to be of the pain only type, central nervous system or inner ear involvement is a remote possibility. Symptoms of inner ear decompression sickness include vertigo, nausea, tinnitus, hearing loss and disequilibrium.

Early detection and rapid treatment are important if recovery is to be complete.

5.4 DECOMPRESSION SICKNESS TREATMENT

Decompression sickness (DCS) during saturation diving may result from excursion ascents or be associated with the saturation decompression. DCS during saturation decompression is fairly common and is usually characterized by pain only. The onset is gradual and generally occurs under pressure. DCS occurring during excursion ascents, however, may be more severe and involve the cardiorespiratory system, the central nervous system and the organs of special sense. This form of DCS is a medical emergency and requires immediate recompression. Even if pain is the only manifestation, treatment should not be delayed.

Treatment of serious DCS consists of immediate recompression at 10m/min. to at least the depth from which the excursion ascent originated. Continued recompression to deeper depths may be indicated if relief is not apparent. Pain only DCS occurring during standard saturation decompression is to be treated by recompression in increments of 5m at 5m/min until distinct improvement is indicated. Recompression more than 10m usually is not necessary, and in some cases may increase the pain. Treatment gas is not to be administered until the treatment depth is reached. Normally, there is no need to exceed 20m for Type 1 bends and 30m (3 Bars) for Type 2 bends.

At treatment depth, treatment gas may be given by mask to provide an O_2 partial pressure of 1.65 - 2.8 atmospheres. Interrupt mask treatment every 20 minutes with 5 minutes of breathing chamber atmosphere. As many as six cycles may be utilized. These can be repeated in 6 hours. Remain at treatment depth a minimum of 12 hours in serious DCS cases and from 2 - 6 hours in the pain only variety.

Resume standard saturation decompression from the treatment depth. More excursion ascents must not be performed.

5.5 FLYING AFTER DIVING

No flying for 48 hours.

5.6 DAILY CLEANING

a. The transfer capsule is to be cleaned each evening using Ivory liquid soap. Particular attention is to be paid to the area of the head, basin and shower. The sewage tank will be emptied after cleaning;

b. It cannot be emphasized too strongly that attention to personal hygiene and cleanliness is the single most important step in the prevention of nosocomial infections.

5.7 FOOD

The lounge and galley area will be inspected daily by the Medical Officer who will report any deficiency in cleanliness to the XO.

PART VI

SCIENTIFIC PROCEDURES

PART VI

SCIENTIFIC PROCEDURES

6.1 INTRODUCTION

This part of the Protocol describes the scientific procedures applicable to the Air Saturation Dive (CEDD Test 1-80) to be conducted in the Diving Research Facility of DCIEM in February.

6.2 SCIENTIFIC OBJECTIVES

This Air Saturation Dive will include five equipment evaluation dives in the Wet Chamber and six scientific experimental periods in the Living Chamber. During the equipment evaluation dives, the AGA ACSC Breathing System and the Superlite-17 System will be tested. Physiological monitoring of the experimental subjects will be performed in conjunction with the equipment evaluation dives to ensure subject safety and to record information to aid in the assessment of equipment performance. The scientific experimental periods will consolidate and extend the initial experience gained during the Chamber Equipment Test Procedures Evaluation (CETPE) of February, 1979. Techniques of cardiovascular and pulmonary function monitoring will be applied to subjects in a hyperbaric environment. Further experience will be gained in the methods that will be used in future dives to assess the manifestations of high pressure neurological syndrome. During the depressurization phase of the dive, subjects will be intermittently examined for the presence of intravascular bubbles using non-invasive Doppler ultrasound monitoring.

6.3 TRAINING

Dive subjects and external operators will receive specific instruction in the objectives of the experimental work during a six-day training period prior to the dive. Details of this training are appended as Annex B to this part.

6.4 EQUIPMENT EVALUATION DIVES

6.4.1 AGA ACSC BREATHING SYSTEM AND SIEMENS ELECTROCARDIOGRAPHIC TELEMETRY SYSTEM

Objectives. The AGA Alternating Closed/Semi-Closed Circuit Breathing System is designed to provide a free diver with appropriate safe breathing mixture. Carbon dioxide is scrubbed from the exhaled gas in a conventional manner using sodasorb. Metabolized oxygen is replenished by a metering system which depends on ventilation and depth. This test will assess the

performance of the system in providing a breathing mixture by monitoring the variation in oxygen and carbon dioxide concentrations under differing workloads, and for various depths and durations of operation. In addition, subjective observations on the general operating characteristics and breathing resistance of the AGA ACSC will be made. This test will also permit an evaluation of the Siemens electrocardiographic telemetry system while submerged and under pressure.

Procedures. The AGA ACSC and the electrocardiographic telemetry system will be tested in the first dive at 9m, and in the third and fifth dive periods at 15.3m. Annex C to Part II of this Protocol describes the Standard Operating Procedures applicable to the use of the AGA ACSC in this dive. In each test period the unit will be used by a diver who will perform various workloads on a vertical bicycle ergometer in the wet chamber. In conjunction with the AGA ACSC the electrocardiographic telemetry transmitter and electrodes will be worn by the diver; the subject will also wear a separate set of electrodes, connected by hard wiring to an electrocardiographic monitor on the surface. Subject rotation and ergometer work levels are defined in Annex E to Part II of the Protocol. Throughout each test period the concentrations of oxygen and carbon dioxide will be measured at the inlet hose and at the mask on a breath-by-breath basis. The work tolerance of the subject will be monitored by continuous recording of heart rate and rhythm by both electrocardiographic telemetry and hard-wired electrocardiography to monitors and recorders on the surface.

Termination Criteria. The equipment test shall be terminated by the Senior Diving Medical Officer under the following conditions:

a. subject distress, at the discretion of the subject;

b. any malfunction of the life-support equipment;

c. oxygen concentration measured as less than 0.2 ATA or greater than 1.6 ATA;

d. carbon dioxide concentration greater than 0.5% surface equivalent (3.8 mmHg) on the inhalation side of the circuit;

e. subject's heart rate exceeding the maximum safe heart rate defined for each subject in pre-dive exercise testing; a list of these heart rates will be available to the Senior Diving Medical Officer throughout the dive; and

f. any cardiac dysrhythmia.

In the event of failure of both the electrocardiographic telemetry and the hard-wired electrocardiographic systems, termination of the experiment will be at the discretion of the Senior Diving Medical Officer.

The equipment listed below is required for this evaluation:

Chemetron Medspect II Mass Spectrometer and sampling line;

Collins Pedal Mode Ergometer and Controller modified for submerged hyperbaric use.

Electrocardiographic leads and electrodes

Tektronix 408 monitor; power supply to include ground fault interrupter

Brush six-channel chart recorder

Siemens electrocardiographic telemetry system modified for submerged use.

6.5 SUPERLITE-17 SYSTEM AND SIEMENS ELECTROCARDIOGRAPHIC TELEMETRY SYSTEM

Objective. The Superlite-17 system is a commercially available, light-weight, diving helmet which has mixed gas capability in the demand mode and permits diver communication. This test will permit subjective assessment of breathing resistance, diver comfort and communication in the Superlite-17 system while the diver is performing bicycle ergometer work at various levels. Gas samples will be taken from the helmet to assess any carbon dioxide that accumulates while the diver is at work. This test will also permit evaluation of the electrocardiographic telemetry system while it is submerged and under pressure.

Procedures. The Superlite-17 system and the electrocardiographic telemetry system will be tested in the second dive period at 9m and the fourth dive period at 34m. Annex D to Part II of this Protocol describes the Standard Operating Procedures applicable to the use of the Superlite-17 system in this dive. In each test period, the diver will perform various workloads on a submerged vertical bicycle ergometer in the wet chamber. In conjunction with the Superlite-17 system, the electrocardiographic telemetry

transmitter and electrodes will be worn by the diver; the subject will also wear a separate set of electrodes connected by hard wiring to an electrocardiographic monitor on the surface. Subject rotation and ergometer work levels are set down in Annex E to Part II of this Protocol. Throughout the test periods, the concentration of carbon dioxide in the helmet will be measured. The work tolerance of the subject will be monitored by continuous recording of heart rate and rhythm by both electrocardiographic telemetry and hard-wire electrocardiography to monitors and recorders on the surface. The pertinent Investigating Scientist must ensure that the equipment to be loaded into the chambers is safe and compatible with the hyperbaric environment. All items must then be checked by the Chief Controller prior to locking them into the complex. They should then be stored in suitable metal containers well in advance of the experiment and in accordance with the Chief Controller's requests.

Termination Criteria. The equipment test shall be terminated by the Senior Diving Medical Officer under the following conditions:

a. subject distress, at the discretion of the subject;

b. any malfunction of the life-support equipment;

c. carbon dioxide concentration exceeding 0.5% surface equivalent (3.8mmHg) in the helmet;

d. subject's heart rate exceeding the maximum safe heart rate defined for each subject in pre-dive exercise testing; a list of these heart rates will be available to the Senior Diving Medical Officer throughout the dive;

e. any cardiac dysrhythmia.

In the event of malfunction of the electrocardiographic telemetry system, termination of the experiment will be at the discretion of the Diving Medical Officer.

For this evaluation, the equipment listed below is required:
Chemtron Medspect II Spectrometer and sampling lines

Collins Pedal Mode Ergometer and Controller modified for submerged hyperbaric use.

Siemens electrocardiographic telemetry system, modified for submerged use.

Electrocardiographic leads and electrodes.

Tektronix 408 Monitor; power supply to include ground fault interruptor.

Brush six-channel chart recorder.

6.6 SCIENTIFIC EXPERIMENTAL PERIODS

Objectives. In each of the six scientific experimental periods, observations of cardiovascular, pulmonary and neurological function will be made. Throughout the depressurization phase of the dive, subjects will be monitored for intravascular bubble presence by Doppler ultrasound technique.

Procedures. Subjects will rotate through a three-station system functioning both as experimental subjects and operators in order to complete the intended measurements in the allotted period. The assignment sequence and timing of tasks for each subject is specified in Annex A.

Cardiovascular Monitoring (Station A). Stroke volume will be determined by the non-invasive measurement of transthoracic electrical impedance according to the method of Kubicek. Electrocardiographic recording will indicate heart rate. Cardiac output will be calculated from stroke volume and heart rate. Blood pressure measurements will be recorded. A finger-prick blood sample will be required from each subject for microhematocrit determination. These samples will also be taken on certain of the pre-dive and post-dive days, so that comparative measurements may be obtained. Initial application of the impedance bands, electrocardiographic electrodes and the sphygomanometer cuff will require four minutes. The subject will then rest supine for six minutes. Impedance cardiographic measurements will then be taken over a two-minute period in the supine position and in the sequence specified in Annex A. On completion of measurements in the supine position this procedure will be repeated for the seated and standing position, using instrumentation specified later in this Protocol.

Pulmonary Monitoring (Station B). Standard spirometric techniques will be used to measure resting tidal volume and vital capacity. Alterations in non-elastic resistance will be sought by performance of a forced expiratory vital capacity manoeuvre. Formal pulmonary function tests will be performed prior to the dive, and following its conclusion, to assess any change in total lung capacity and residual volume. At Station B, the first operator will check the calibration of the rolling seal spirometer on command from the surface, using a 1-litre plexiglass syringe. The piston will then be set to the starting

point and the experimental subject, wearing a nose clip, will perform his pulmonary manoeuvres on command from the surface. Six minutes is allotted for pulmonary function measurements on each subject.

Neurological Monitoring (Station C). Intention tremor will be monitored using a strain-gauge transducer. The standing subject will place the index finger of his dominant hand on the strain gauge arm. Movement will be recorded for a period of one minute. Postural tremor will be monitored using a device incorporating an accelerometer. The subject will hold the accelerometer device in the dominant hand with the arm outstretched at shoulder level. Movement will be recorded for a period of one minute. Two subjects will be monitored concurrently at Station C, one for intention tremor and one for postural tremor. Four minutes are allotted for assessment of intention and postural tremor for each subject.

Doppler Monitoring. Non-invasive Doppler ultrasound monitoring will be performed prior to and during the decompression phases of the dive. Base-line recordings of each subject will be taken on the surface prior to pressurization. Two Doppler monitoring units will be used. They will be located at each end of the living chamber to allow the surface operators to observe each subject on closed-circuit television during Doppler monitoring. In the third experimental period the final twenty-five minutes will be used to obtain 12 minutes of base-line Doppler ultrasound monitoring of each subject prior to the excursion to 34m. On depressurization to 15.3m, Doppler monitoring will be performed in accordance with serial 0046 from 1202-1215 and serial 0048 from 1330-1400. During the ascent from 15.3m, Doppler monitoring will be performed at approximately 2100 during the reel change of the evening film. The initial and last 25-minute periods of the sixth experimental period and serial 0075 will also be devoted to Doppler monitoring. Further Doppler monitoring during ascent will be conducted when deemed appropriate and on request by the Watch Officer. Doppler monitoring will continue on the surface in accordance with Annex A to Part II. During each Doppler monitoring session, two communication channels will be required. The DUG units are to be connected to the surface recording units by coaxial chamber penetration. The experimental subjects shall wear headphones connected to the communications network which will carry the audio Doppler signal to assist the subject in correct positioning of the Doppler probe over the right heart. Recording will then be started and the subject will perform deep knee bend manoeuvres on command from the surface.

Termination Criteria. With the exception of the finger-prick blood sample for microhematocrit determination, all procedures in the scientific experimental periods are non-invasive and certified as inherently safe. Experiments shall be terminated in the event of any subject distress or equipment malfunction.

The equipment listed below is required for these monitoring procedures:

Cardiovascular Monitoring - Station A

Inside

1. Aneroid sphygmomanometer with cuff, microphone and pressure transducer.
2. Impedance cardiographic tapes - 4 precut bands/ subject in each experimental period.
3. Scissors, alligator clips - 4 clips/subject.
4. Metric steel tape measure.
5. Impedance cardiography connecting cables - 1/subject.
6. Self-adhesive ECG electrodes.
7. ECG paste.
8. ECG leads.
9. Microlance, microhematocrit tubes, sealer, Zephiran solution and swabs.

Outside

1. ECG monitor.
2. IFM cardiac function monitor.
3. IFM impedance cardiograph.
4. Beckman Chart Recorder.

Pulmonary Function Monitoring - Station B

Inside

1. Ohio 822 Rolling Seal Spirometer (modified for hyperbaric chamber use) with 4 mouthpieces, 1 set hoses.
2. Calibration syringe.

Outside

1. Brush chart recorder.

2. Battery power supply for spirometer.

Neurological Monitoring - Station C

Inside

1. Strain-gauge tremor transducer and leads.

2. Accelerometer device and leads.

Outside

1. Beckman chart recorder.

2. Hewlett-Packard tape recorder.

Doppler Monitoring

Inside

1. 2 Doppler monitoring units (DUG).

2. 2 headsets.

3. 2 containers of ultratrasound gel.

4. 2 Doppler transducer units.

5. Wiping towels for gel removal.

Outside

1. 2 recording units with switch box, 2 stereo cassette recorders, headsets.

2. Spare AA cells for DUG units.

ANNEX A
TO PART VI
CEDD TEST 1-80

SCIENTIFIC EXPERIMENTAL PERIODS - TASKING AND ROTATION OF SUBJECT

1. This portion of the Protocol describes the tasks and the timing of tasks to be performed by the experimental subjects during each scientific experimental period.

2. Each subject is identified in the schedule as shown below:

Lt Kooner RN - S1
Capt Porlier - S2
MCpl Lessard - S3
MCpl Regier - S4

3. The schedule is designed to rotate each subject through the three experimental positions in order to allow for equipment set-up and calibration and to provide rest periods prior to each impedance cardiography measurement. The schedule is laid out in five vertical columns: the left-hand column specifies the approximate time from the start of the scientific experimental period. The four remaining columns specify the activity of each subject at each point in time.

4. Each experimental position is identified by a letter: Station A is the impedance cardiography position; Station B is the pulmonary function position and Station C is the tremor monitoring position. Station C comprises two sub-stations: intention tremor position and postural tremor position.

	SUBJECT			
APPROX. ELAPSED TIME	S1 Lt Kooner RN	S2 Capt Porlier	S3 MCpl Lessard	S4 MCpl Regier
2	sets up and checks calibration of Stn B	prepares self for Stn A with aid of S3 and S4	helps prepare S2	helps prepare S2.
4				
6		prepares S4 for Stn A	helps prepare S4	prepared for Stn A
8				
10		prepares S3 for Stn A	prepared for Stn A	rests supine
12				
14	prepared for Stn A	prepares S1 for Stn A	plugs in S4 then rests supine	
16				data collection supine Stn A.
18	rests supine	rests supine		plugs in S3 then rests seated
20			data collection Stn A	
22			plugs in S1 then rests seated	
24	data collection supine Stn A			
26	plugs in S2 then rests seated	data collection supine Stn A		
28		plugs in S4 then rests seated		data collection Stn A

	SUBJECT			
APPROX. ELAPSED TIME	S1 Lt Kooner RN	S2 Capt Porlier	S3 MCpl Lessard	S4 MCpl Regier
30			data collection seated Stn A	plugs in S3 then rests standing
32	data collection seated Stn A		plugs in S1 then rests standing	
34	plugs in S2 then rests standing	data collection Stn A		
36		plugs in S4 then rests standing		data collection Standing Stn A
38			data collection standing Stn A	plugs in S3 proceeds to Stn B
40	data collection standing Stn A		plugs in S1 proceeds to Stn C	data collection Stn B
42	plugs in S2 then waits on availability of Stn B	data collection standing Stn A	data collection Stn C	
44		waits for availability of Stn C		
46			data collection Stn B	proceeds to Stn C
48				data collection Stn C
50				

ANNEX A
TO PART VI
CEDD TEST 1-80

	SUBJECT			
APPROX. ELAPSED TIME	S1 Lt Kooner RN	S2 Capt Porlier	S3 MCpl Lessard	S4 MCpl Regier
52	data collection Stn B	proceeds to Stn C		
54		data collection Stn C		
56				
58	proceed to Stn C	data collection Stn B		
60	data collection Stn C			
62				

ANNEX B
TO PART VI
CEDD TEST 1-80

SUBJECT TRAINING AND PRE-DIVE ASSESSMENTS

FOR AIR SATURATION DIVE FEBRUARY, 1980

Tuesday, 22 Jan:

a.m.	Familiarization swim for subjects with AGA ACSC at CFB Toronto pool.
p.m.	Slow SOP walkthrough, bicycle ergometer, wet pot - AGA ACSC

Wednesday, 23 Jan:

a.m.	Preparation of Superlite-17
p.m.	Slow SOP walkthrough, bicycle ergometer, wet pot - Superlite-17

Thursday, 24 Jan:

a.m.	Subject training for scientific experimental period:
0830-0915	Impedance Cardiography:
	Briefing - 30 min. Demonstration - 15 min. - Capt Porlier
0915-1015	Pulmonary Function Tests:
	Briefing - 30 min. Demonstration - 30 min. - Capt Seary
1030-1100	Intention and Postural Tremor Testing:
	Briefing - 15 min. Demonstration - 15 min. - Mr. Eastman
1100-1200	Doppler Monitoring:
	Briefing - 30 min. Demonstration - 30 min. - Mr. Eatock

ANNEX B
TO PART VI
CEDD TEST 1-80

SUBJECT TRAINING AND PRE-DIVE ASSESSMENTS

FOR AIR SATURATION DIVE FEBRUARY, 1980

1300-1445	Subjects will practise the station-by-station rotation through the scientific experiments.
1500-1530	Subjects will practise probe placement for Doppler monitoring.

Friday, 25 Jan:

As directed by Project Officer

Monday, 28 Jan:

0900-	Bounce Dive 340 ft chamber to check blood sample transport to surface.
1300	SOP - Superlite/AGA ACSC - with full monitoring
	SOP - typical scientific experimental period rehearsal - complete

Tuesday, 29 Jan:

Pulmonary Function Testing at Mt. Sinai Hospital:

0845	MCpl Lessard
0945	MCpl Regier
1045	Lt Kooner RN
1500	Briefing Meeting - Main Auditorium

Wednesday, 30 Jan:

Pulmonary Function Testing - Mt Sinai Hospital:

0945	Capt Porlier
0900-1200	Pre-dive Medical Examinations
	Subjects and Spares - OPI LCdr Buckingham

ANNEX B
TO PART VI
CEDD TEST 1-80

SUBJECT TRAINING AND PRE-DIVE ASSESSMENTS

FOR AIR SATURATION DIVE FEBRUARY, 1980

1300	Base-line and control values: impedance cardiography, pulmonary function, postural and intention tremor.
Thursday, 31 Jan:	
	Pre-dive maximal exercise testing on bicycle ergometer - Exercise Physiology Lab
	Subjects - 0900
1430	Formal rehearsal of scientific experimental period.
1530	Base-line Doppler monitor recording.
Friday, 1 Feb:	
	Subjects as directed by Lt Kooner
	Spares - maximal exercise testing on bicycle ergometer. Exercise Physiology Lab - 0900
Monday, 4 Feb:	
0900-1200	DRF Preps.
1000-1100	Pre-dive briefing of subjects by Diving Medical Officer and Sat Diving Project Officer
1100-1200	Lunch

ANNEX C
TO PART VI
CEDD TEST 1-80

CONSENT TO PARTICIPATE

1. I, _____, have been asked to participate as a test subject in the Air Saturation Dive, CEDD Test 1-80.

2. I understand that this dive is to be conducted by the Canadian Experimental Diving Division of DCIEM for the following purposes:

a. to acquire experience in saturation diving;

b. to acquire experience in the operation of the Diving Research Facility and its sub-systems;

c. to test the AGA ACSC Diving System;

d. to test the Superlite-17B Diving System;

e. to test the Siemens Electrocardiographic Telemetry System modified for submerged use;

f. to determine the effects of exposure to prolonged increased pressure by measurement of cardiac output, pulmonary volumes and tremor;

g. to gain further experience in monitoring for the presence of intravascular bubbles by the Doppler ultrasound technique.

I have read the Protocol "Air Sat Dive, CEDD Test 1-80" which describes in detail the time-depth profile of the dive, the procedures for the conduct of the dive, the procedures for the equipment tests and the scientific experiments.

3. I understand that the testing of equipment will require me to perform work on a submerged bicycle ergometer and that this will expose me to the normally accepted risks of underwater work. I understand that during the testing of the AGA ACSC Diving System, the composition of the breathing mixture will be monitored and that the test will be terminated if the mixture fails to conform to the limits specified in the test Protocol. I further understand that whenever I work on the submerged bicycle ergometer, my heart rate will be continuously monitored and will not be permitted to exceed a limit established as safe for me in exercise testing performed prior to the dive. I understand that the experiments to be performed in the scientific experimental periods will require a fingerprick blood sample, but that these experiments are

ANNEX C
TO PART VI
CEDD TEST 1-80

otherwise non-invasive and inherently safe. I recognize that in decompression from a saturation dive there is a risk of decompression sickness, and, as in any exposure to altered ambient pressure, the risks of barotrauma and arterial gas embolism exist. I understand that participation in this saturation dive will require my close confinement with the remaining three experimental subjects; that throughout the dive I shall be under continuous observation by closed-circuit television, and that, with the exception of private discussion of medical problems with the Diving Medical Officer, all my conversations will be monitored. I recognize that, should I develop any medical problem during the dive, I would be unable to leave the Diving Research Facility until after an appropriate decompression from the saturation exposure. However, I understand that, in the event of a medical problem, it would be possible for medical personnel to enter the chambers. I understand that on completion of the dive I must adhere to the decompression sickness watch and the prohibition from hypobaric exposure specified in the Protocol.

4. The Senior Diving Medical Officer on staff with DCIEM has discussed the Protocol with me. We have also discussed the potential physiological risks associated with my participation in this experiment. My current state of health has been reviewed. These discussions have taken place in private. I have undergone pulmonary function testing, exercise testing and a medical examination prior to my participation in this dive. I understand that before the dive commences I am obliged to inform the Senior Diving Medical Officer of any changes in my medical status since his original assessment. This information will include any medication taken by me and any medical or dental treatment that I have received since signing this consent.

5. I understand that a Medical Officer belonging to the Canadian Experimental Diving Division will be present in the DCIEM building throughout the dive. I understand that the only physiological monitoring procedures that may be used in association with this dive are those to which I have given my specific consent.

6. This consent is voluntary and has been given under circumstances in which I have been able to exercise free choice. I have been informed that I may at any time revoke my consent and withdraw from this dive without prejudice; however, I do recognize that, should I terminate my participation, I would not be able to leave the Diving Research Facility until an appropriate decompression from saturation and decompression watch has been completed. I agree that my participation in the tests, experiments or dive may be terminated by the Director, Diving Division at any time regardless of my wishes.

ANNEX C
TO PART VI
CEDD TEST 1-80

7. Statement of the Senior Diving Medical Officer

I have interviewed _____ in private as required in paragraph 4 of this form. I am satisfied that this subject comprehends the nature of his participation in this dive and that his consent to participate is informed and given freely.

_____
SENIOR DIVING MEDICAL OFFICER

8. I, _____ consent to participate as a test subject in the Air Saturation Dive, CEDD Test 1-80.

_____
VOLUNTEER

_____
DIRECTOR, DIVING DIVISION

_____
DATE


DA
FILM